Transformation of the European gas infrastructure towards a climate-neutral energy system

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DLR Institute of Networked Energy Systems

Knowledge for Tomorrow

How do we transport our energy in future?
By means of hydrogen through the existing natural gas grid?
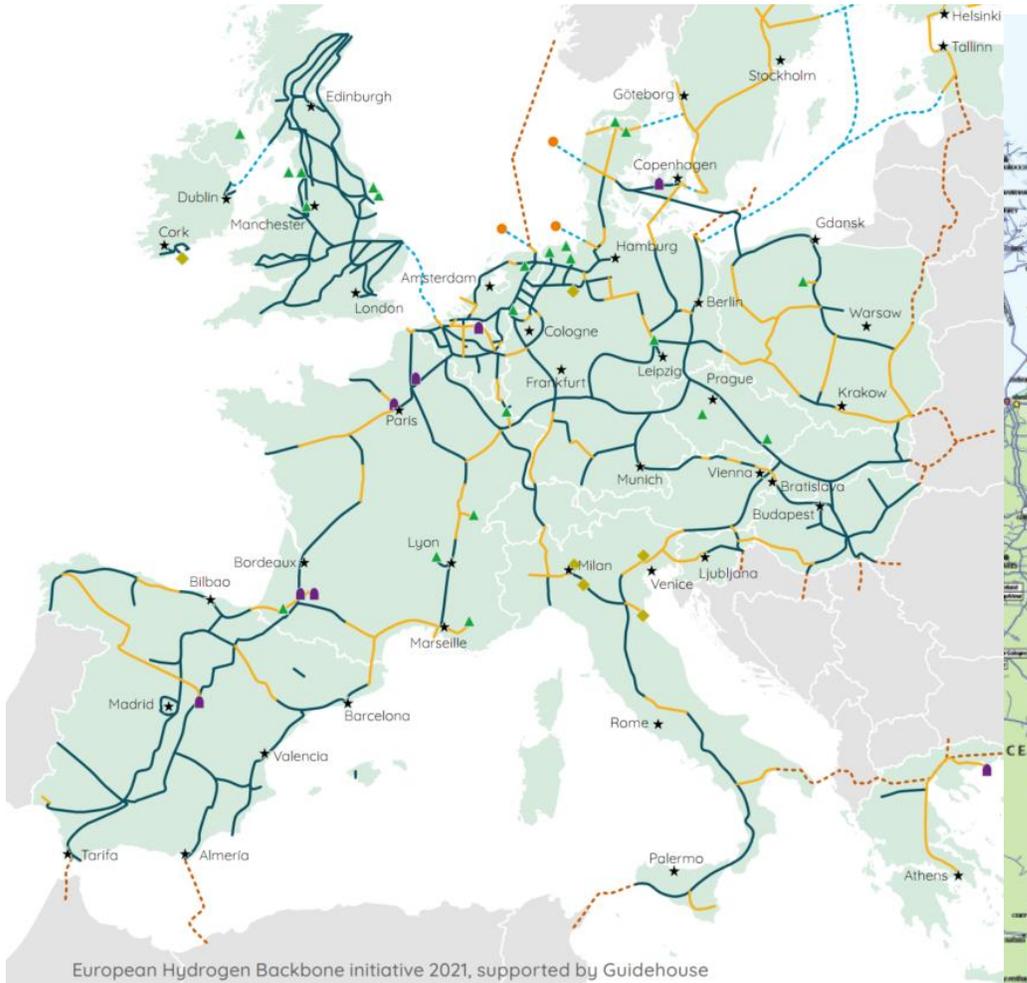
European Hydrogen Backbone initiative 2021, supported by Guidehouse

Clear "no-regret" routes (hexagons contain the ID and the demand in 2050 in TWh)   Figure ES-3

Clear "no-regret" (TSOs study – conversion)

Clear "no-regret" (outside TSOs study – assumed new builds)
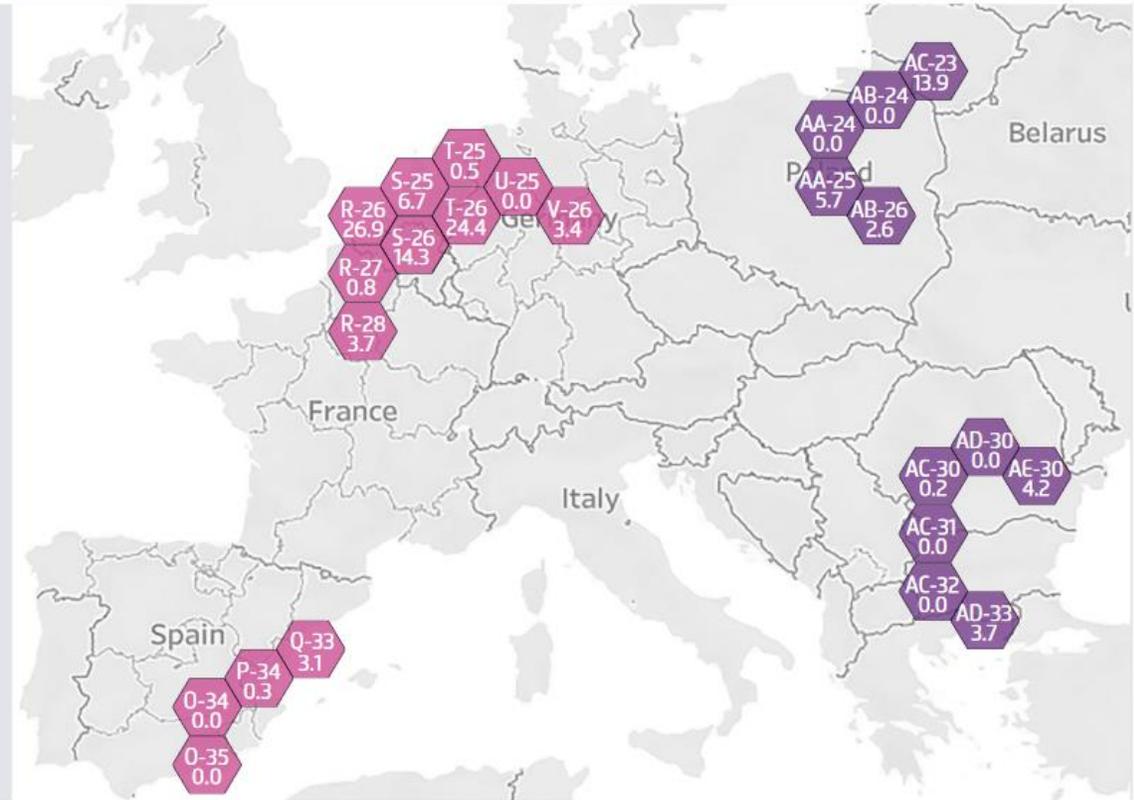
AFRY analysis. © 2020 Mapbox © OpenStreetMap.

Source: ENTSOG / GIE Development Map 2019/2020, 11 January 2021

Main research questions

PhD project start
in March 2021

**What are cost-effective transformation strategies for the European gas
infrastructure towards a climate-neutral integrated energy system?**

- How do renewable gases contribute to the security of
  supply in the electricity, heat and transport sectors?

- How does energy transportation via hydrogen
  influence the expansion of the electricity grid?

- Which transport infrastructure and storages for
 hydrogen and methane will be needed in the future?
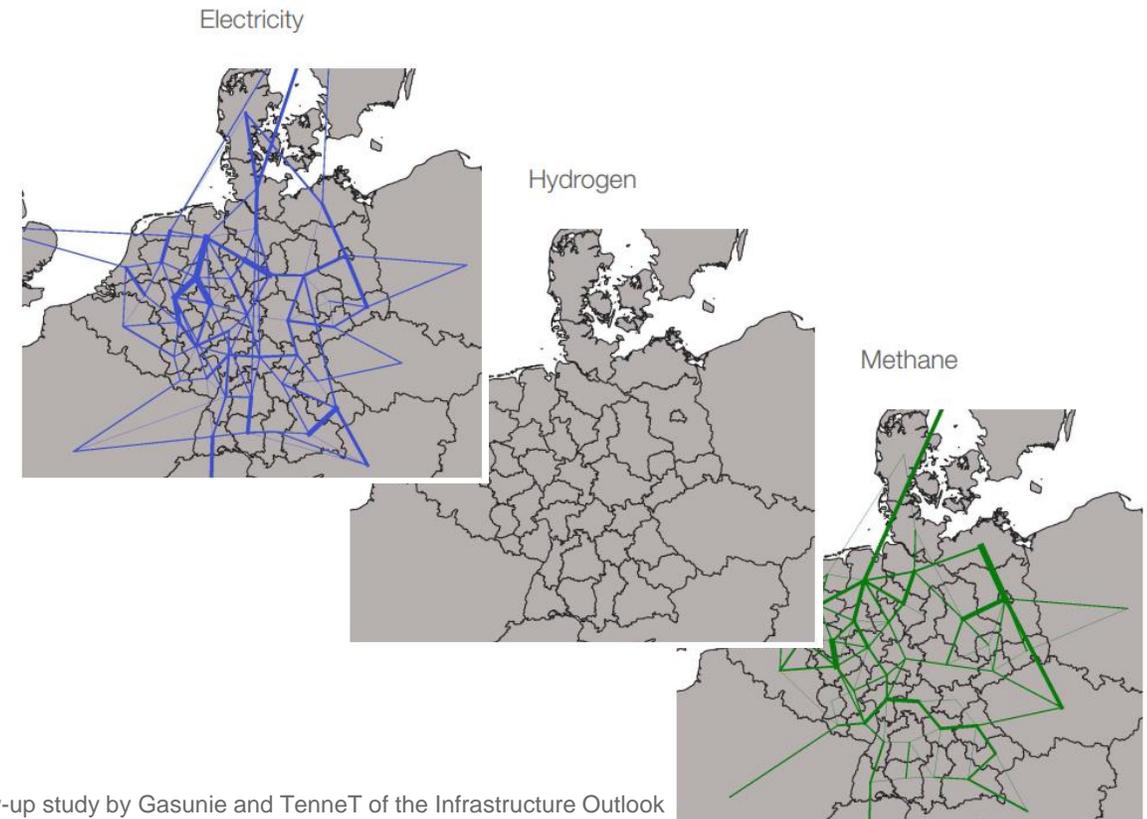
Figure source: DBI Gas- und Umwelttechnik GmbH et al. (2020): Phase II - Pathways to 2050. A joint follow-up study by Gasunie and TenneT of the Infrastructure Outlook 2050. https://www.tennet.eu/fileadmin/user_upload/Company/News/German/Hoerchens/2020/200204_Phase_II_Project_report.pdf.

Extending existing REMix modelling framework for spatially highly resolved electricity, natural gas and hydrogen transportation
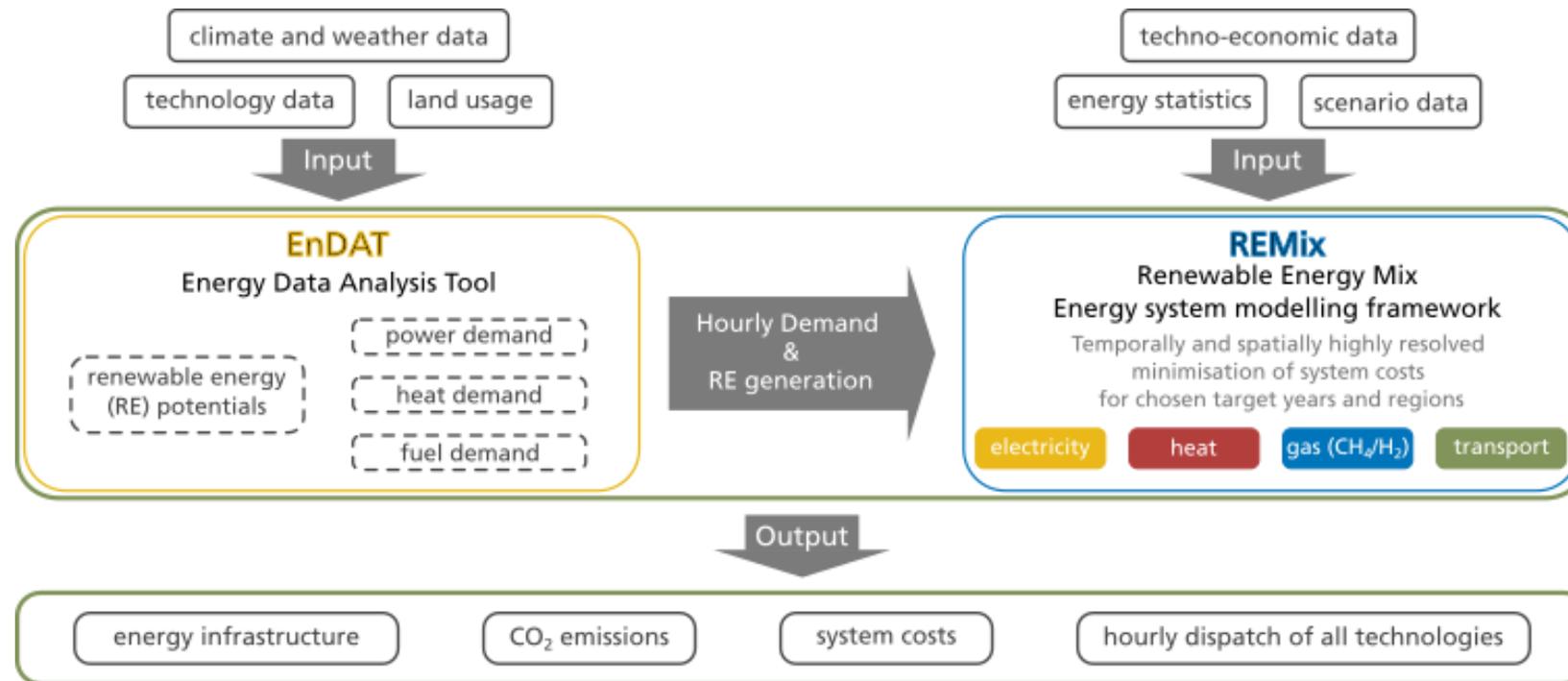
(mixed-integer) linear optimisation of European energy system

*REMix and EnDAT are DLR-internal tools that are planned to be made open source in the future (~2022);
reference: Scholz (2012): Renewable energy based electricity supply at low costs: Development of the REMix model and application for Europe

Computational challenges are expected due to model size

- 70 regions to model European energy system

- more than 90 technologies

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